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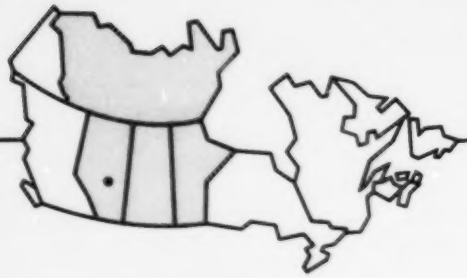
D.H. Kuhnke and L.G. Brace



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SILVICULTURE STATISTICS FOR CANADA, 1975-76 TO 1982-83

D.H. Kuhnke and L.G. Brace

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ABSTRACT

Silviculture activities including site preparation, planting, direct seeding, stand tending, and pest control are summarized for each province and territory and for Canada for 1975-76 to 1982-83. As the period 1975-76 to 1979-80 is covered in a previous report, comparisons are made between that period and the incremental 1980-81 to 1982-83 period to gauge the progress of silviculture activities. The level of silviculture activities is also discussed in relation to the harvesting rate. The basic area data on site preparation, planting, and direct seeding have been refined with the use of information on site preparation application and silviculture success rates. It is concluded that increased silviculture effort is warranted if the area of forest land reverting to an inadequately reforested state is to be reduced.

RÉSUMÉ

Dans le présent ouvrage sont résumées les activités sylvicoles pour chaque province et territoire ainsi que pour le Canada entier, notamment en ce qui concerne la préparation de terrain, le plantage, l'ensemencement direct, l'entretien des peuplements et la lutte contre les ravageurs, pour la période de 1975-76 à 1982-83. On compare également l'ampleur des activités sylvicoles par rapport à la superficie récoltée. Outre les données de base sur les superficies préparées, plantées et ensemencées directement, on présente des statistiques sur les applications des opérations de préparation de terrain et les taux de réussite. On arrive à la conclusion qu'un effort sylvicole accrû est justifié afin de réduire la superficie des terres forestières laissées insuffisamment reboisées.

FOREWORD

The FORSTATS (FORestry STATisticS) program provides current statistical information on Canada's forest resources, including periodic descriptions and analyses of forest inventory and growth; insect, disease, and fire losses; nursery production and silvicultural practice; and social and economic conditions.

FORSTATS involves the direct participation of the Canadian Forestry Service Headquarters in Ottawa, the FORSTATS project at the Petawawa National Forestry Institute at Chalk River, Ont., and the Pacific Forestry Centre in Victoria, B.C., Northern Forestry Centre in Edmonton, Alta., Great Lakes Forestry Centre in Sault Ste. Marie, Ont., Laurentian Forestry Centre in Ste. Foy, Que., Maritimes Forestry Centre in Fredericton, N.B., Newfoundland Forestry Centre in St. John's, Nfld., the Forest Pest Management Institute in Sault Ste. Marie, Ont., and other federal agencies.

The FORSTATS program would not be possible without the cooperation of provincial agencies and the forest industry in providing data.

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INTRODUCTION

This report continues and enhances the reporting of national silviculture statistics begun in 1975 by Brace and Golec (1982). These reports are part of a national effort to provide current information on the status of Canada's forest resources under the Canadian Forestry Service's FORSTATS (FORest STATisticS) program. Silviculture research, technology transfer, and financial assistance for reforestation, stand tending, and pest control programs under specific federal-provincial agreements complete the federal role in Canadian silviculture. The practice of silviculture is a provincial responsibility for the majority of publicly owned forest lands in Canada.

This continuation of the first report includes 3 years of additional data, for the years 1980–81 to 1982–83. The data are enhanced by an analysis of site preparation application and silviculture success rates. The need for this level of refinement was identified in the Brace and Golec report.

The main purpose of this report is to provide an overview of the operational scale and trends in Canadian silviculture, particularly reforestation and stand tending, which are seen as key components of forest management aimed at increasing dwindling timber supplies.

Smyth et al. (1984) reported on forest management expenditures in Canada for the period 1977–82. They found that silviculture expenditures by all agencies increased by 54% (from $118 million to $272 million) from 1977 to 1982. During the same period, silviculture expenditures as a percentage of all forest management expenditures increased from 17% to 22%. The role of joint federal-provincial agreements was included in the report. Recently, new joint federal-provincial forest renewal and forest development agreements have been signed for all provinces in Canada except Newfoundland, whose Forest Subsidiary Agreement terminated in 1985. These new agreements provide substantial support for silviculture for the period 1983 to 1990, identifying 50.8% of the total budget of $1.75 billion primarily for nursery development, forest renewal, and stand tending. These expenditures should be reflected in silviculture statistics by 1985–86.

In a recent article on obstacles to silviculture in Canada, Pearse (1985) noted that as Canada's source of raw material for forestry shifts from natural to managed crops, the policy framework that influences investments in silviculture becomes critical. He contends that there is a need to provide policy makers with information on the economics of silvicultural investments so that allocations of funds by government can be made more efficiently. He further states that this information, combined with tax incentives and appropriate tenure arrangements, would stimulate forest management more efficiently than would government subsidies to silviculture.

The statistics reported here are insufficient to determine the adequacy or efficiency of silviculture efforts in the forest management programs of any particular province or territory. Such evaluation would require a complete set of data on all depletions and accruals in the forest estate (Petawawa National Forestry Institute 1984) as well as an understanding of the policies and regulations of the province or territory concerned. Such detailed information is not available for most of Canada.

METHODS

Data Collection

As was done for the earlier report, data were collected using a questionnaire (Brace and Golec 1982) designed and distributed by the CFS FORSTATS committee and completed by provincial forestry personnel. This second questionnaire included an additional section (Appendix 1) that made the refinement of the basic areal data possible. The data were transferred to a computer data base at the Northern Forestry Centre.

Data Analysis

Analytical procedures were the same as those used in the earlier report, including the identification of data gaps and the estimation of missing data in consultation with each province and territory. Government and industry data were combined for analysis. Due to the limited availability

of acceptable data, the supplemental questions used for the 1980–81 to 1982–83 period required considerable follow-up.

Canada-wide summary tables were prepared for the 8-year period 1975–76 to 1982–83 and for 1980–81 to 1982–83 where considered appropriate for inclusion in the text. Detailed provincial and territorial data are provided in Appendix 2.

The analysis includes tables showing site preparation, planting, and direct seeding as percentages of current cutover area. These tables provide an approximate measure of the magnitude of silviculture relative to that of harvesting. The percentages do not truly reflect the distribution of these treatments because the treatments were not solely applied within current cutover areas. The division of these activities between the current cutover, repeated treatments, and inadequately restocked backlog areas is unknown.

RESULTS AND DISCUSSION

Harvesting

Harvesting increased 28.4% in the 1975–76 to 1979–80 period but then declined 10.9%, reflecting a general slowdown in the forest economy (Table 1). British Columbia, Alberta, Manitoba, and New Brunswick showed signs of recovery in harvest rate in 1982–83. Quebec, Ontario, British Columbia, and New Brunswick continued to have the highest average area harvested. Clear-cutting continued to be the most common harvesting technique (Fig. 1).

Site Preparation

Site preparation, though used mainly to increase the survival and growth of planted seedlings, is also used prior to direct seeding and for enhancement of natural regeneration. Of the total area receiving site preparation, 63.8% was then planted, 22.2% was direct seeded, and 15.0% was left to naturally regenerate (Table 2). These percentages varied widely across Canada. The amount of site preparation used to re-treat failure areas is not known, but may be quite high. Data for spruce and pine species groups for the period 1980–81 to 1982–83 (Appendix 3) show that 29.0% of planted areas and 47.0% of direct seeded areas required re-treatment; many of these areas would require site preparation.

For 1980–81 to 1982–83, site preparation continued the upward trend of 1975–76 to 1979–80 (Table 3). For all site preparation methods there was a 19.1% increase from 1975–76 to 1979–80 and an 11.9% increase from 1980–81 to 1982–83.

Scarification continued to be the most commonly used site preparation technique (Fig. 2). This reflects recent increases in the area of scarification in Alberta, Saskatchewan, and Ontario (Appendix 2). Prescribed burning was the next most common site preparation technique, accounting for 14.8% of all site preparation from 1980–81 to 1982–83 (Fig. 2).

Chemical site preparation was used primarily in Ontario during the period 1975–76 to 1982–83. New Brunswick's use of the practice has increased to 2 364 hectares from 198 hectares in the first period. New Brunswick also reported chemical treatment in combination with scarification in 1981–82 (Appendix 2). This method of site preparation is expected to increase as more chemicals become registered for forestry use in Canada.

The area of site preparation as a percentage of the area harvested is shown in Table 4. There is little evidence of a trend until 1980–81, after which there is a definite increase of 6.3% from 1980–81 to 1982–83. This increase is partly a reflection of reduced harvest levels as well as absolute increases, particularly in Alberta, Ontario, Quebec, and New Brunswick. Site preparation as a percentage of area harvested increased from 21.0% in the first period to 24.7% in the 1980–81 to 1982–83 period. Alberta had the highest rate of site preparation as a percentage of area harvested (69.7%); next were Saskatchewan (39.3%) and British Columbia (36.2%).

Planting, Direct Seeding, and Natural Regeneration

Area planted continued to increase yearly over the period 1975–76 to 1982–83. A 26.0% increase occurred from 1980–81 to 1982–83 compared to a 10.8% increase from 1975–76 to 1979–80, reflecting accelerating increases in

Table 1. Area harvested

Province or territory	Area harvested (ha)								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	156 976	175 952	166 081	196 533	187 547	187 834	147 889	162 172	1 380 984
Alberta	20 256	19 060	21 450	22 103	24 689	29 762[a]	32 302	37 120	206 742
Saskatchewan	13 814	9 727	14 231	14 909	20 396	20 746	19 690	(19 700)	133 213
Manitoba	(15 700)[b]	(17 000)	(18 000)	(20 000)	24 600	24 600	18 900	20 400	159 200
Ontario	196 760	156 721	187 993	194 998	218 578	242 679	227 603	222 921	1 648 253
Quebec	135 094	181 737	193 295	226 127	241 826	245 000	250 000	195 000	1 668 079
New Brunswick	(94 400)	(92 800)	(86 500)	(89 200)	(100 000)	(85 900)	(65 500)	(72 445)	(686 745)
Nova Scotia	27 260	26 285	28 335	32 120	33 703	36 439	36 429	35 710	256 281
Prince Edward Island	1 600	1 600	1 600	1 600	1 780	(2 500)	(2 700)	(2 700)	16 080
Newfoundland	(15 700)	(14 700)	(14 300)	(17 600)	(17 700)	15 175	13 454	8 000	116 629
Yukon Territory	620	560	747	935	280	58	45	43	3 288
Northwest Territories	706	396	688	693	629	742	903	427	5 184
Canada	678 886	696 538	733 220	816 818	871 728	891 435	815 415	776 638	6 280 678

[a] In 1980–81, 1981–82, and 1982–83, 6 720, 11 785, and 10 091 hectares were cleared of aspen under a special stand conversion program and were not harvested in the commercial sense.

[b] Numbers in brackets are estimates.

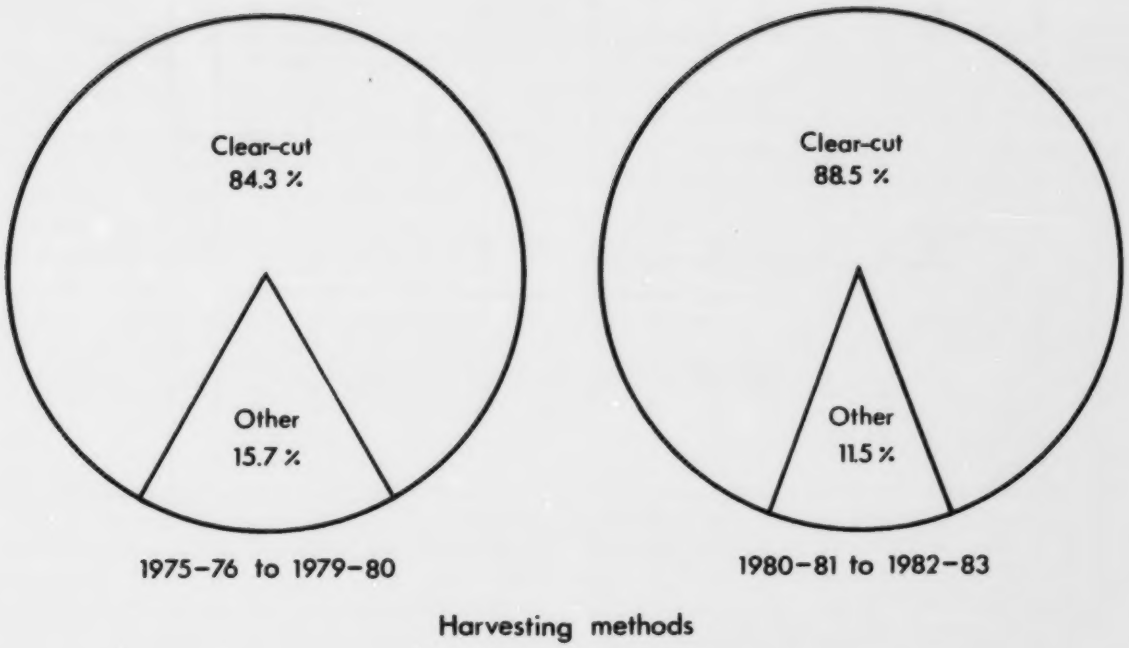

Figure 1. Harvesting methods in Canada, 1975–76 to 1979–80 and 1980–81 to 1982–83.

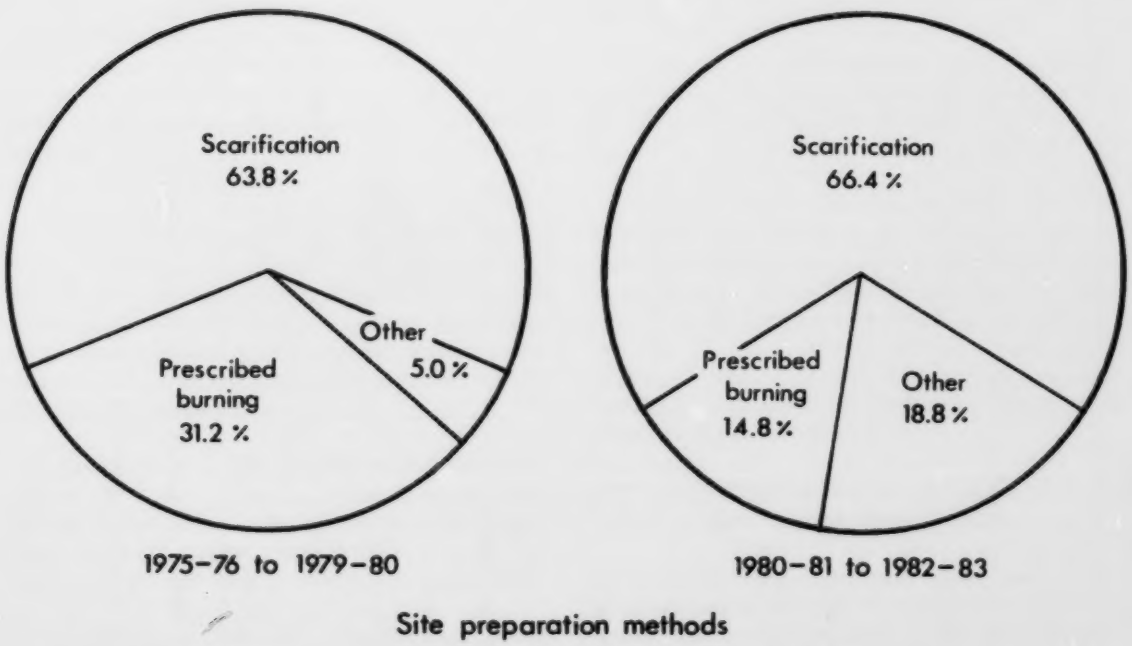

Figure 2. Site preparation methods in Canada, 1975–76 to 1979–80 and 1980–81 to 1982–83.

Table 2. Percentage breakdown of site preparation area by regeneration method, 1980–1981 to 1982–83

Province or territory	Total area of site preparation (ha)	Regeneration method used (%)			Total % use of site preparation
		Natural regeneration	Direct seeding	Planting	
British Columbia	182 718	18.0	0.0	82.0	100.0
Alberta	61 327	35.5	52.1	12.4	100.0
Saskatchewan	27 147	40.0	0.0	60.0	100.0
Manitoba	11 843	32.5	8.3	59.2	100.0
Ontario	184 761	6.0	43.0	51.0	100.0
Quebec	44 855	0.0	53.0	47.0	100.0
New Brunswick	70 911	0.0	0.0	100.0	100.0
Nova Scotia	24 265	46.5	0.2	53.3	100.0
Prince Edward Island	1 366	0.0	0.0	100.0	100.0
Newfoundland	3 552	0.0	0.0	100.0	100.0
Yukon Territory	0	0.0	0.0	0.0	0.0
Northwest Territories	0	0.0	0.0	0.0	0.0
Canada	612 745	15.0	22.2	63.8	100.0

Table 3. Area of site preparation

Province or territory	Area of site preparation (ha)								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia[a]	73 809	77 249	48 169	51 408	67 295	65 194	54 893	62 631	500 648
Alberta	15 822	14 944	18 905	18 635	14 536	15 856	18 905	26 566	144 169
Saskatchewan	2 267	5 717	3 905	6 344	6 951	7 056	7 125	12 966	52 321
Manitoba	3 965	4 038	4 080	4 443	4 356	4 055	4 161	3 627	32 725
Ontario	45 231	39 157	47 961	48 706	53 390	56 620	57 157	70 984	419 206
Quebec	3 008	2 570	7 555	9 539	14 769	13 903	16 152	14 800	82 296
New Brunswick	10 100	11 000	13 900	16 000	18 500	24 926	27 384	18 601	140 411
Nova Scotia	595	634	850	2 608	2 255	8 010	8 845	7 410	31 207
Prince Edward Island[a]	0	48	0	16	566	566	289	511	1 996
Newfoundland	0	0	28	320	1 508	379	1 317	1 856	5 408
Yukon Territory	0	0	0	0	224	0	0	0	224
Northwest Territories	0	0	0	0	0	0	0	0	0
Canada	154 797	155 357	145 353	158 009	184 350	196 565	196 228	219 952	1 410 611

[a] Data does not include areas found not to require treatment.

Table 4. Area of site preparation as a percentage of area harvested

Province or territory	% site preparation								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	47.0	43.9	29.0	26.2	35.9	34.7	37.1	38.6	36.2
Alberta	78.1	78.4	88.1	84.3	58.9	53.2	58.5	71.6	69.7
Saskatchewan	16.4	58.8	27.4	42.5	34.1	34.0	36.2	65.8	39.3
Manitoba	(25.2)[a]	(23.8)	(22.7)	(22.2)	(17.7)	16.5	22.0	17.8	20.6
Ontario	23.0	25.0	25.5	25.0	24.4	23.3	25.1	31.8	25.4
Quebec	2.2	1.4	3.9	4.2	6.1	5.7	6.5	7.6	4.9
New Brunswick	(10.7)	(11.9)	(16.1)	(17.9)	(18.5)	(29.0)	(41.8)	(25.7)	(20.4)
Nova Scotia	2.2	2.4	3.0	8.1	6.7	22.0	24.3	20.8	12.2
Prince Edward Island	0.0	3.0	0.0	1.0	31.8	22.6	10.7	18.9	12.4
Newfoundland	0.0	0.0	(0.2)	(1.8)	(8.5)	2.5	9.8	23.2	4.6
Yukon Territory	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	6.8
Northwest Territories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canada	22.8	22.3	19.8	19.3	21.1	22.0	24.1	28.3	22.5

[a] Numbers in brackets are estimates.

recent years, particularly in British Columbia, Alberta, and New Brunswick (Table 5).

The proportion of area planted with container stock has increased considerably relative to the 1975–76 to 1979–80 period (Fig. 3). Among the four provinces that planted more area with container than bare-root seedlings from 1980–81 to 1982–83, Alberta and New Brunswick had the highest percentages of container use (77.3% and 64% of total area planted).

The area planted as a percentage of the area harvested rose from 16.9% in the 1975–76 to 1979–80 period to 20.9% in the 1980–81 to 1982–83 period (Table 6). This reflects the general increase in planting activity, although reduced harvest levels in 1980–81 to 1982–83 inflate these figures to some extent.

Direct seeding continued to be practiced mainly in Alberta, Ontario, and Quebec (Table 7). The annual totals in the current period fluctuate widely, with the greatest amount of direct seeding occurring in 1980–81 because of an upsurge of the practice in Ontario. Although direct seeding declined 22.6% from 1980–81 to 1982–83, it has increased 34.4% between 1975–76 and 1982–83. The average annual area direct seeded from 1980–81 to 1982–83 of 52 636 hectares is considerably higher than the 37 432 hectare average for 1975–76 to 1979–80, indicating that the practice is increasing in recent years.

For Canada as a whole, direct seeding accounted for 6.4% of the area harvested for 1980–81 to 1982–83, up from 4.9% for 1975–76 to 1979–80 (Table 8). Jack pine was the most commonly seeded species in Ontario and Quebec, while Alberta seeded with lodgepole pine and white spruce, separately and in mixtures.

The relative successes of planting and direct seeding from 1980–81 to 1982–83 are shown in Table 9, based on data for pine (*Pinus* spp.) and spruce (*Picea* spp.) with and without site preparation. Success for planting spruce and pine species averaged 66.8% and 81.3% with an overall average of 71.0% planting success. Success rates for direct seeding were 87.5% for spruce and 49.3% for pine,

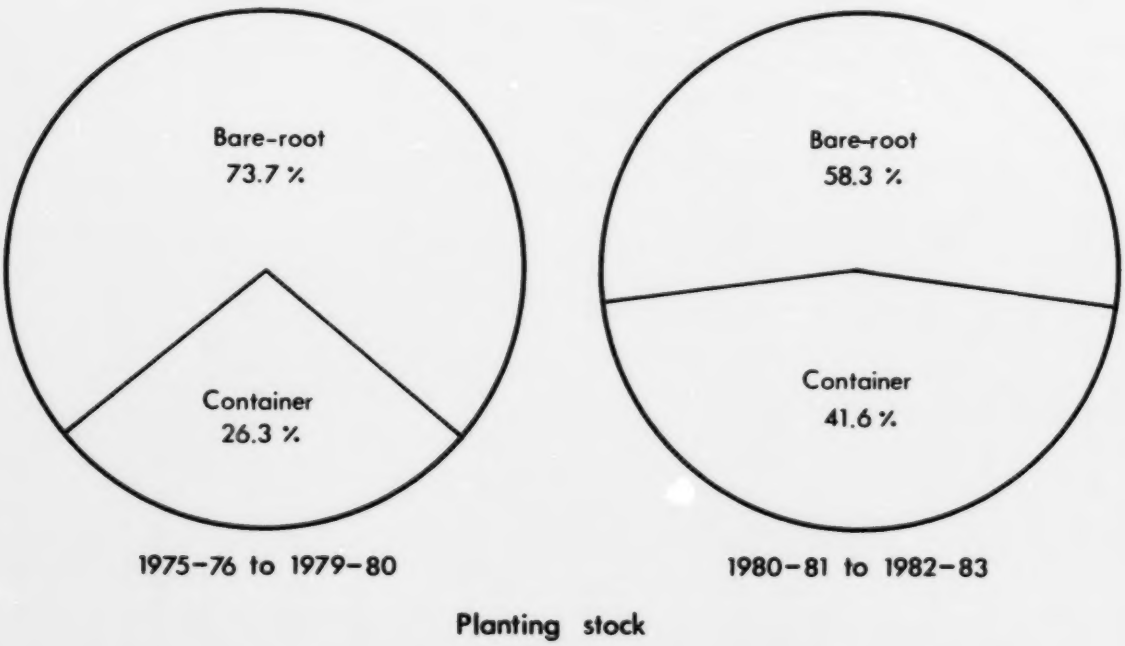

Figure 3. Planting stock type usage in Canada, 1975–76 to 1979–80 and 1980–81 to 1982–83.

Table 5. Area planted[a]

Province or territory	Area planted (ha)								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	(63 078)[b]	(60 161)	(55 741)	(58 269)	(63 677)	(63 675)	(66 605)	(82 795)	(514 001)
Alberta	6 016	4 799	5 484	7 145	8 264	11 556	12 989	18 107	74 360
Saskatchewan	3 554	4 439	6 231	6 591	5 683	4 109	6 865	6 270	43 742
Manitoba	1 116	1 046	832	1 220	570	762	4 134	2 203	11 883
Ontario	30 050	26 170	26 507	27 549	30 830	32 080	38 107	37 842	249 135
Quebec	15 905	15 329	16 544	14 079	14 062	13 841	15 875	17 077	122 712
New Brunswick	6 675	8 050	9 607	10 700	15 700	22 038	22 121	22 458	117 349
Nova Scotia	1 425	1 230	2 331	3 290	2 676	3 741	5 085	4 249	24 057
Prince Edward Island	120	120	120	94	84	423	490	475	1 926
Newfoundland	0	0	0	0	184	360	1 853	802	3 199
Yukon Territory	0	0	0	0	0	0	0	0	0
Northwest Territories	0	0	0	0	0	0	0	0	0
Canada	127 939	121 344	123 397	128 937	141 730	152 585	174 124	192 278	1 162 364

[a] Container and bare-root stock.

[b] Numbers in brackets are estimates.

Table 6. Area planted as a percentage of area harvested

Province or territory	% area planted								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	(40.2)[a]	(34.2)	(33.6)	(29.6)	(34.0)	(33.9)	(45.0)	(51.0)	(37.2)
Alberta	29.7	25.2	25.6	32.3	33.5	38.8	40.2	48.8	36.0
Saskatchewan	25.7	45.6	43.8	44.2	27.9	19.8	34.9	31.8	32.8
Manitoba	(7.1)	(6.2)	(4.6)	(6.1)	(2.3)	3.1	21.9	10.8	7.5
Ontario	15.3	16.7	14.1	14.1	14.1	13.2	16.7	17.0	15.1
Quebec	11.8	8.4	8.6	6.2	5.8	5.6	6.3	8.8	7.4
New Brunswick	(7.1)	(8.7)	(11.1)	(12.0)	(15.7)	(25.7)	(33.8)	(31.0)	(17.1)
Nova Scotia	5.2	4.7	8.2	10.2	7.9	10.3	14.0	11.9	9.4
Prince Edward Island	7.5	7.5	7.5	5.9	4.7	16.9	18.1	17.6	12.0
Newfoundland	0.0	0.0	0.0	0.0	(1.0)	2.4	13.8	10.0	2.7
Yukon Territory	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northwest Territories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canada	18.8	17.4	16.8	15.8	16.3	17.1	21.4	24.8	18.5

[a] Numbers in brackets are estimates.

Table 7. Area of direct seeding

Province or territory	Area of direct seeding (ha)								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	0	0	0	0	0	0	0	0	0
Alberta	7 906	6 470	7 668	5 416	4 539	6 635	4 701	5 400	48 735
Saskatchewan	0	0	0	0	0	0	0	0	0
Manitoba	223	199	61	126	2 774	1 093	272	118	4 866
Ontario	23 510	27 039	28 791	23 582	24 251	47 294	27 869	29 991	232 327
Quebec	5 693	1 810	3 373	5 703	6 744	9 949	9 525	14 506	57 303
New Brunswick	125	550	393	0	0	0	172	9	1 249
Nova Scotia	0	10	1	127	77	0	0	55	270
Prince Edward Island	0	0	0	0	0	0	0	0	0
Newfoundland	0	0	0	0	0	36	54	230	320
Canada	37 457	36 078	40 287	34 954	38 385	65 007	42 593	50 309	345 070

Table 8. Area of direct seeding as a percentage of area harvested

Province or territory	% area direct seeded								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alberta	39.0	33.9	35.7	24.5	18.4	22.3	14.6	14.5	23.6
Saskatchewan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manitoba	(0.1)[a]	(1.2)	(0.0)	(0.6)	(11.3)	4.4	1.4	0.6	3.1
Ontario	11.9	17.3	15.3	12.1	11.1	19.5	12.2	13.5	14.1
Quebec	4.2	1.0	1.7	2.5	2.8	4.1	3.8	7.4	3.4
New Brunswick	(0.1)	(0.6)	(0.5)	0.0	0.0	0.0	(0.3)	0.0	(0.2)
Nova Scotia	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.1	0.1
Prince Edward Island	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newfoundland	0.0	0.0	0.0	0.0	0.0	0.2	0.4	2.9	0.3
Canada	5.5	5.2	5.5	4.3	4.4	7.3	5.2	6.5	5.5

[a] Numbers in brackets are estimates.

Table 9. Percentage of areas artificially regenerated with spruce and pine that become satisfactorily stocked to provincial standards without re-treatment, 1980–81 to 1982–83

Province	Planting			Direct seeding		
	Spruce	Pine	Average of total spruce and pine	Spruce	Pine	Average of total spruce and pine
British Columbia	50.0[a]	80.0	57.4	N/A[b]	N/A	N/A
Alberta	90.0	80.0	88.7	(90.0)[c]	(90.0)	(90.0)
Saskatchewan	95.0	80.0	89.9	N/A	N/A	N/A
Manitoba	(75.0)	(100.0)	(88.9)	—[d]	—	—
Ontario	58.0	78.0	66.6	N/A	48.0	48.0
Quebec	—	—	—	50.0	50.0	50.0
New Brunswick	95.0	95.0	95.0	—[e]	—[e]	—
Nova Scotia	40.0	40.0	40.0	30.0	80.0[f]	80.0
Prince Edward Island	88.0	88.0	88.0	N/A	N/A	N/A
Newfoundland	100.0	N/A	100.0	—[e]	—[e]	—
Canada[g]	66.8	81.3	71.0	87.5	49.3	53.0

[a] Brushing and weeding required to maintain plantation.

[b] Not applicable.

[c] Numbers in brackets are estimates.

[d] Not available.

[e] Results not yet available; practice is currently experimental.

[f] Refers to jack pine; <50% for white and red pine.

[g] National averages are weighted by area.

averaging 53.0% direct seeding success. Planting success rates for three provinces that practice direct seeding (Alberta, Ontario, and Nova Scotia) average 70.6%.

Relative planting and seeding success rates have considerable impact on the interpretation of planting and direct seeding statistics. Assuming that these figures represent all species, the application of a 71.0% success rate to planting area figures for the period 1975–76 to 1982–83 reduces area planted as a percentage of area harvested from 18.5% to 13.1%. Applying a 53.0% success rate to direct seeding figures reduces the percentage of harvested area seeded from 5.5% to 2.9%. Such refinements of the silvicultural data base require further confirmation for all species concerned, but point out the inadequacy of using basic areal data to plan and assess the progress of silvicultural programs.

Although these figures generally reflect a reduction of stocking rather than complete failure of an area, they can be applied on an area basis to illustrate their effect. It is assumed that success rates were assessed after allowances were made for ingress. The incremental planting and direct seeding figures resulting from the relative success rates actually become reforested lands during some future period, as several years must elapse before planted or seeded lands can be deemed satisfactorily or unsatisfactorily stocked. It is also assumed that none of the current reforestation efforts are applied to past failure areas. The actual amount of the current reforestation effort applied to past failure areas is unknown. It is dependent upon the area planted and direct seeded in previous years and the lag between reforestation and regeneration success assessment, which varies according to provincial regulations and site-species characteristics. Another time lag inherent in the application of success rates arises because success rates are derived from regeneration efforts in years prior to those to which they are applied. Success rates are expected to increase through improved silvicultural practices in the 1980s. Regeneration success rates are separate again from the question of how many plantations, even if successfully established, reach a free-to-grow state without tending.

The 46.3% overall success rate of natural regeneration (Table 10) is an improvement over the estimated 30% success rate shown in the earlier report. Success rates for natural regeneration are much lower than those for planting and lower than those for direct seeding but can be considerably improved through site preparation. Alberta, for instance, reported that 50–60% of scarified areas left to regenerate naturally to white spruce did so, compared to 20–25% of non-scarified areas. The data in Table 10 are broad averages encompassing natural regeneration with and without site preparation and several species of spruce and pine within each group.

Stand Tending

Stand tending data are summarized in Table 11. The data consist of information for fertilizing, thinning, pruning, and weeding by manual, mechanical, and chemical means (Appendix 2). The upward trend in stand tending is exemplified by the 214.5% increase in area treated between 1975–76 and 1982–83, up from 121.7% in the 1975–76 to 1979–80 period. Stand tending decreased slightly (2.1%) from 1980–81 to 1982–83, but 63.7% of all stand tending reported from 1975–76 to 1982–83 occurred from 1979–80 to 1982–83. Ontario and British Columbia accounted for 67% of all stand tending from 1980–81 to 1982–83, down from 91.3% in the previous survey. This reflects an average increase in stand tending reported in other provinces, particularly Quebec, New Brunswick, and Nova Scotia.

Thinning and chemical weeding accounted for 76.8% of all tending activities in the 1975–76 to 1979–80 period and 83.0% of all tending activities in the 1980–81 to 1982–83 period (Fig. 4). There were substantial increases in chemical weeding activity in Ontario and New Brunswick. British Columbia accounted for 36% of the thinning and 95% of the fertilization reported in the 1980–81 to 1982–83 period (Appendix 2).

Pest Control

There is no clear trend in pest control activity for the 1980–81 to 1982–83 period (Table 12), and the major activity continues to be spruce budworm control in New Brunswick and Quebec; these two provinces account for 54.5% and 42.5% of pest control activity for 1975–76 to 1979–80 and 70.1% and 28.2% for 1980–81 to 1982–83. Pest control statistics continue to reflect response to variable pest buildups and persistence, therefore, the predictability of scale and trend of this activity appears to be low.

Table 10. Percentage of harvested lands expected to become satisfactorily stocked to provincial standards through natural regeneration, 1980–81 to 1982–83

Province	Harvested area by species group (ha)			Success rates (%)		Area of successful regeneration (ha)			Average natural regeneration success rate (%)
	Spruce	Pine	Spruce & pine	Spruce	Pine	Spruce	Pine	Spruce & pine	
British Columbia[a]	119 461	105 089	224 550	20.0	70.0	23 892	73 562	97 454	43.4
Alberta[b]	48 535	42 384	90 919	23.0	50.0	11 163	21 192	32 355	35.6
Saskatchewan	37 405	17 740	55 145	10.0	35.0	3 740	6 209	9 949	18.0
Manitoba[b]	34 041	21 247	55 288	40.0	40.0	13 616	8 499	22 115	40.0
Ontario[c]	313 810	238 673	552 483	50.0	46.0	156 905	109 790	266 695	48.3
Quebec[b]	332 657	42 737	375 394[d]	50.0	0.0[e]	166 328	0	166 328	44.3
New Brunswick	101 339	84 946[f]	186 285	50.0	50.0[h]	50 670	38 531[i]	89 201	47.9
Nova Scotia[b]	54 453	36 040[g]	90 493	66.0	66.0	35 939	23 786	59 725	66.0
Prince Edward Island	2 497	552[h]	3 049	27.0	58.0[j]	674	320	994	32.6
Newfoundland	12 820	23 809[h]	36 629	65.0	85.0	8 333	20 238	28 571	78.0
Canada	1 057 018	613 217	1 670 235	44.6	49.3	471 260	302 127	773 387	46.3

[a] Spruce and pine accounted for 45.1% of total harvest.

[b] Harvest by species not available. Inventory species composition data was used as a proxy for harvesting by species.

[c] Spruce and pine accounted for 79.7% of total harvest.

[d] An additional 182 500 ha of predominantly balsam fir forest was harvested; regeneration success rates are not available.

[e] Regeneration is insignificant on a province-wide scale; actual figure not available.

[f] Mostly balsam fir, 11.6% pine.

[g] Mostly balsam fir, 24.5% pine.

[h] Balsam fir.

[i] Includes a 10% success rate for pine.

[j] Spruce and balsam fir.

Table 11. Area of all methods of stand tending

Province or territory	Area stand tending (ha)								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	1 841	9 733	23 435	26 586	33 279	30 877	37 677	26 031	189 459
Alberta[a]	143	906	123	152	272	350	967	1 397	4 310
Saskatchewan[b]	0	0	0	0	142	367	369	68	946
Manitoba[c]	562	377	558	624	220	263	0	0	2 604
Ontario	33 277	38 324	52 850	48 269	39 228	51 036	41 444	54 506	358 934
Quebec	—[d]	—	—	—	—	10 829	12 686	6 446[e]	29 961
New Brunswick[f]	0	0	1 032	1 807	3 436	18 924	17 618	18 263	61 080
Nova Scotia	1 334	1 625	2 146	2 504	3 556	7 451	9 264	5 923	33 803
Prince Edward Island	0	0	0	0	20	49	353	1 112	1 534
Newfoundland	251	236	2 340	2 327	2 790	33	2 615	3 901	14 493
Yukon Territory	0	0	0	0	0	0	0	0	0
Northwest Territories	0	0	0	0	0	0	0	0	0
Canada	37 408	51 201	82 484	82 269	82 943	120 179	122 993	117 647	697 124

[a] Mostly thinning; includes 52 ha and 184 ha of chemical weeding in 1980–81 and 1981–82.

[b] Mostly manual weeding; includes 177 ha of chemical weeding in 1981–82 and 68 ha of thinning in 1982–83.

[c] Thinning only.

[d] Not available.

[e] Precommercial thinning only. Data on other treatments are not available.

[f] Figures for 1977–78 to 1979–80 differ from those in Brace and Golec (1982) because they were received after the publication date.

Table 12. Area of pest control

Province or territory	Area pest control (ha)								
	1975–76	1976–77	1977–78	1978–79	1979–80	1980–81	1981–82	1982–83	Total
British Columbia	1 785	2 667	2 384	2 908	2 287	1 564	3 830	0	17 425
Alberta	0	0	0	0	0	0	0	0	0
Saskatchewan	0	0	0	0	0	0	0	0	0
Manitoba	0	0	0	0	0	0	0	0	0
Ontario	14 167	41 060	10 522	4 085	22 702	36 422[a]	11 733	3 827	144 518
Quebec	(2 800 000)[b]	(2 900 000)	(1 400 000)	(1 200 000)	(600 000)	188 511	705 164	1 298 495	11 092 170
New Brunswick	2 695 000	3 881 000	1 682 000	1 554 000	1 598 000	1 900 000	1 693 000	1 867 570	16 870 570
Nova Scotia	0	0	556	25 670	30 752	25 670	31 195	19 153	132 996
Prince Edward Island	0	0	0	0	0	0	0	0	0
Newfoundland	0	0	76 910	376 600	5 870	0	0	0	459 380
Yukon Territory	0	0	0	0	0	0	0	0	0
Northwest Territories	0	0	0	0	0	0	0	0	0
Canada	5 510 952	6 824 727	3 172 372	3 163 263	2 259 611	2 152 167	2 444 922	3 189 045	28 717 059

[a] Includes herbicides and pesticides.

[b] Numbers in brackets are estimates.

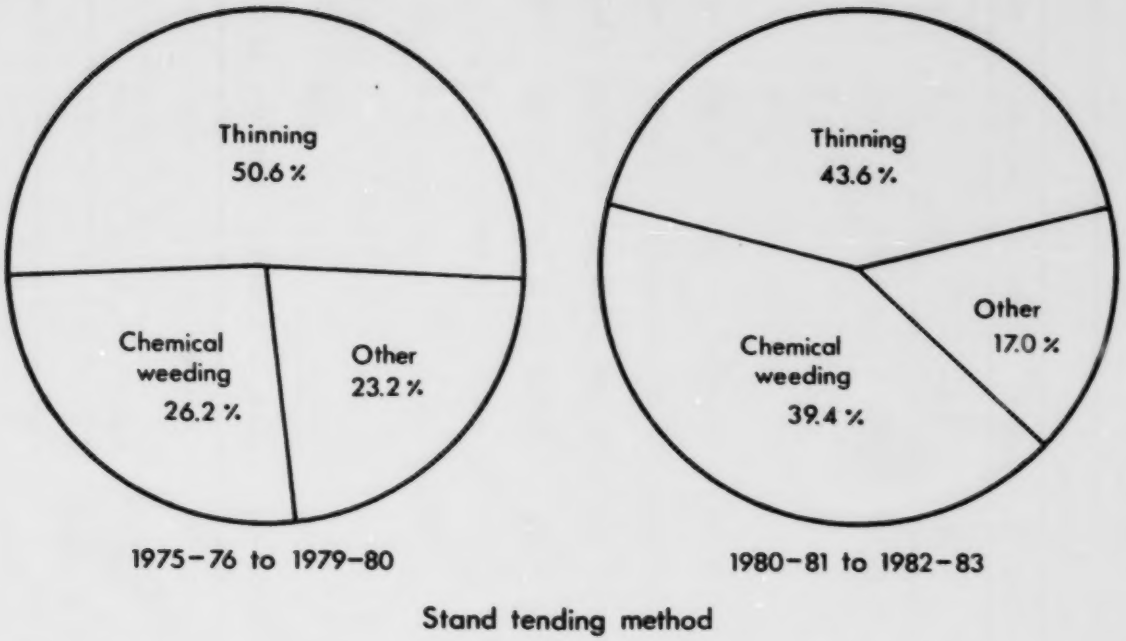

Figure 4. Stand tending methods in Canada, 1975–76 to 1979–80 and 1980–81 to 1982–83.

SUMMARY AND CONCLUSIONS

This report fulfills the objective of updating national silviculture statistics reporting established in 1982. Additionally, a number of topics referred to but not addressed in the first report have been discussed here. These are the percentage breakdown of site preparation area by regeneration method and estimates of the success rates of planting, direct seeding, and natural regeneration.

Percentage changes in harvesting and silvicultural activities are summarized in Table 13. With the exception of harvesting, which showed a decline in the 1980–81 to 1982–83 period coinciding with a general slowdown in the economy as a whole and in the forest sector in particular, activities generally increased throughout the entire survey period.

Site preparation increased to 24.7% of area harvested in the 1980–81 to 1982–83 period compared to 21.0% in the previous period. Scarification was the most commonly used technique (64.8%) followed by prescribed burning (24.1%). Chemical site preparation changed little from 1975–76 to 1982–83 but is expected to increase because of new, recently registered chemicals. New information on site preparation indicates that for Canada as a whole, 63.8% was used for planting, 22.2% for direct seeding, and 15.0% for natural regeneration. No current data are available to indicate the amount of site preparation used for treatment of failure areas, though it may be high, judging from the success rates of planting and direct seeding operations.

The breakdown of site preparation area by regeneration method is one of the steps in determining the relationship between site preparation, regeneration method, and success rate. Complications arise from time lags between various treatments. Future reports will attempt to examine these relationships more closely, including isolation of the influence of site preparation on success rates.

Planting and direct seeding percentages showed increases throughout most of the 1975–76 to 1982–83 period (Table 13). New information on natural regeneration raised its estimated success rate from 30% to 46.3%. Regeneration by planting,

Table 13. Silviculture percentages for Canada

Silviculture activity	Percentage increases in silviculture activity			Silviculture percentages relative to the area harvested		
	1975–76 to 1979–80	1980–81 to 1982–83	1975–76 to 1982–83	1975–76 to 1979–80	1980–81 to 1982–83	1975–76 to 1982–83
Harvesting	28.4	(12.9)[a]	(14.4)	N/A[b]	N/A	N/A
Site preparation	19.1	11.9	42.1	21.1	24.7	22.5
Planting	10.8	26.0	50.3	16.9	20.9	18.5
Direct seeding	2.5	(22.6)	34.3	4.9	6.4	5.5
Stand tending	121.7	(2.1)	214.5	N/A	N/A	N/A

[a] Brackets indicate a decrease.

[b] Not applicable.

direct seeding, and natural regeneration methods therefore totaled 70.3% of the average cutover area, up from 51.9% in the 1975–76 to 1979–80 period. This leaves 29.7% of average current cutover area in an inadequately reforested state, even with an assumption of total success in planting and direct seeding operations. New data gathered for these activities indicates success rates of 71.0% and 53.0% for planting and direct seeding. Applying these rates on an area basis to the above calculations results in 62.3% of the current cutover area being successfully reforested, leaving the remainder in an inadequately reforested state. Fully 74.2% of the successful reforestation in Canada is attributable to natural regeneration. Figure 5 highlights the changes in the area of each activity over the 8-year period.

Stand tending is dominated by thinning and chemical weeding, which together accounted for 77.5% of all stand tending activities in the 1975–76 to 1982–83 period. Chemical weeding is expected to increase, since new chemicals have recently been registered for that purpose. The potential benefits of stand tending for maintaining silvicultural investments and providing additional timber supplies, in both the short and long term, will likely be realized on an increasing scale based on the large increase shown over the 1975–76 to 1982–83 period.

Pest control activities continued to focus on spruce budworm control, primarily in New Brunswick and Quebec, where 98.3% of all reported pest control from 1980–81 to 1982–83 took place. The predictability of pest control activities tends to be low due to the variable nature of pest buildup and persistence.

Data in this report indicate that although silviculture activities are increasing in an absolute sense and relative to the area harvested, increased silvicultural effort is warranted if the ever-increasing area of forest land reverting to an unsatisfactorily restocked state is to be reduced. The statistics reported here provide only a general overview of silvicultural practices in Canada. Their utility for addressing questions of the overall adequacy or efficiency of silviculture as a component of forest management is limited by the fact that they are only a subset of statistical data covering all depletions and accruals in the forest estate. Several provinces are developing comprehensive record-keeping systems to gain and maintain a clear picture of operating techniques and results of their silvicultural programs. These systems may be coupled with other systems or integrated into a large system to monitor all aspects of change in the forest land base and growing stock. Such complete change data (which would require more-detailed silvicultural information than is now collected) combined with economic analyses of silvicultural opportunities are becoming increasingly necessary for forest policy makers, planners, and managers as forest management practices intensify, particularly in key timber-producing regions of Canada. There is a particular need for economic analysis of silvicultural opportunities because of the large investments made possible through joint federal-provincial renewal and development agreements, which will be providing approximately $900 million for silviculture in Canada between 1985 and 1990.

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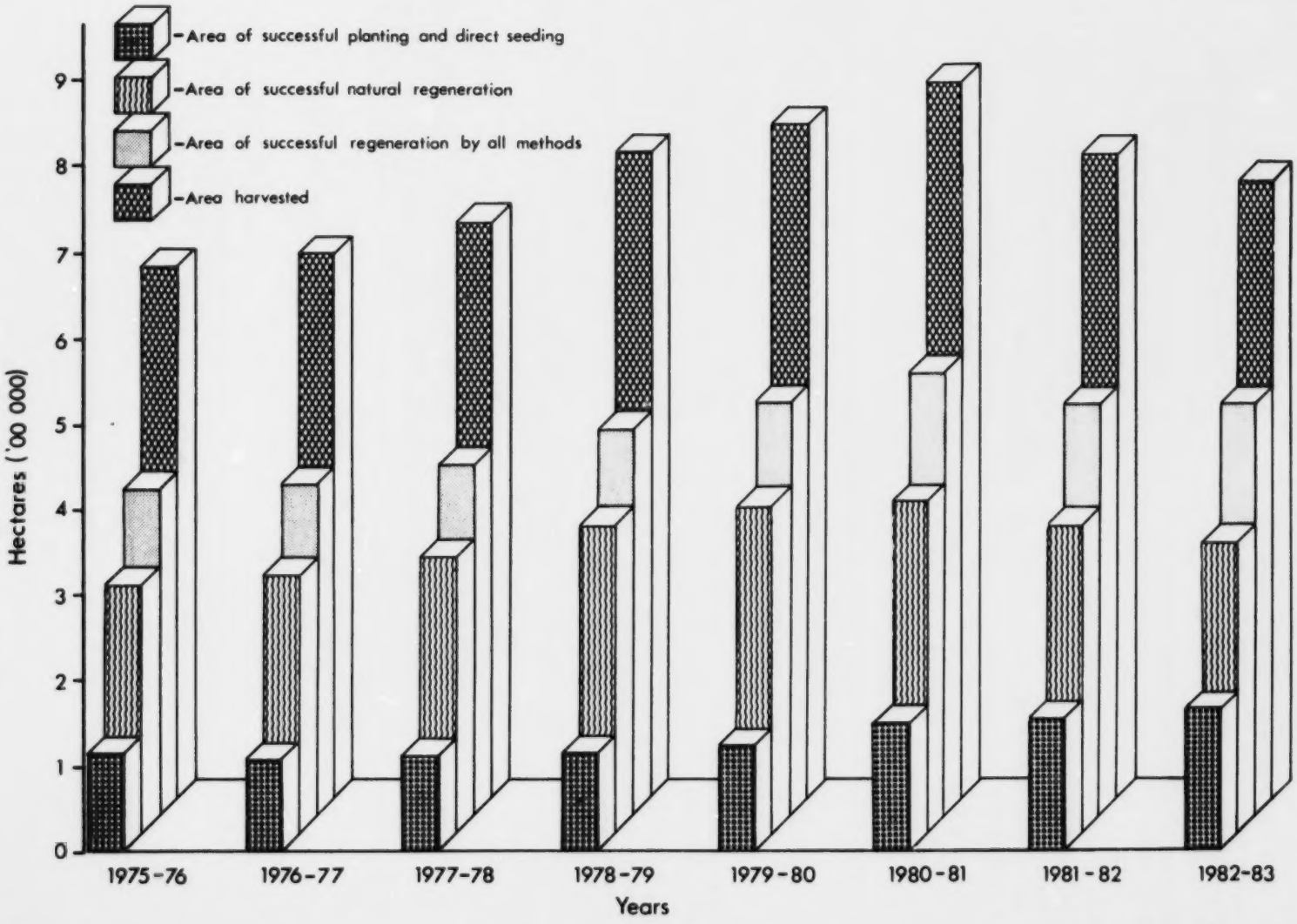

Figure 5. Area of successful regeneration compared to area harvested for Canada, 1975-76 to 1982-83 (based on 1980-81 to 1982-83 national average success rates).

Gilbert Aubin,
FORSTATS, Laurentian Forestry Centre;
Marc Lamontagne,
FORSTATS, Laurentian Forestry Centre;
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APPENDIX 1

QUESTIONNAIRE SUPPLEMENT

QUESTIONNAIRE SUPPLEMENT
AN OVERVIEW OF TREATMENT EFFECTIVENESS

1. Do you have provincial standards for determining regeneration success?

2. On the average, what percentage of the area harvested is expected to become satisfactorily stocked without supplemental planting or seeding?

   Spruce
   Pine
   Other

3. On the average, what percentage of planted areas remains satisfactorily stocked without re-treatment?

   Spruce
   Pine
   Other

4. On the average, what percentage of artificially seeded areas becomes satisfactorily stocked without re-treatment?

   Spruce
   Pine
   Other

5. What percentage of all site preparation is usually done for purposes of:

   Natural regeneration
   Seeding
   Planting

6. Do you conduct routine surveys of field performance (survival and/or growth) on your established forest plantations?

7. Do you have data on stand treatment effectiveness?

	Yes	No
Increased growth and yield		
— due to fertilizing	_____	_____
— due to thinning	_____	_____
Increased stand or stem quality		
— due to thinning	_____	_____
— due to pruning	_____	_____
Success of weed control		
— mechanical	_____	_____
— chemical	_____	_____
Success of pest control		
— mechanical	_____	_____
— chemical	_____	_____

APPENDIX 2

PROVINCIAL AND TERRITORIAL DATA

Table A. Harvesting, site preparation, and planting and seeding data for British Columbia

Table B. Harvesting, site preparation, and planting and seeding data for Alberta

Table C. Harvesting, site preparation, and planting and seeding data for Saskatchewan

Table D. Harvesting, site preparation, and planting and seeding data for Manitoba

Table E. Harvesting, site preparation, and planting and seeding data for Ontario

Table F. Harvesting, site preparation, and planting and seeding data for Quebec

Table G. Harvesting, site preparation, and planting and seeding data for New Brunswick

Table H. Harvesting, site preparation, and planting and seeding data for Nova Scotia

Table I. Harvesting, site preparation, and planting and seeding data for Prince Edward Island

Table J. Harvesting, site preparation, and planting and seeding data for Newfoundland

Table K. Harvesting, site preparation, and planting and seeding data for the Yukon Territory

Table L. Harvesting, site preparation, and planting and seeding data for the Northwest Territories

Table M. Stand treatments in British Columbia

Table N. Stand treatments in Ontario

Table O. Stand treatments in Quebec

Table P. Stand treatments in New Brunswick

Table Q. Stand treatments in Nova Scotia

Table R. Stand treatments in Prince Edward Island

Table S. Stand treatments in Newfoundland

Table A. Harvesting, site preparation, and planting and seeding data for British Columbia

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	133 277	23 699	60 615	13 194	0	(50 440)[a]	(58 257)	(12 638)	(14 564)	(63 078)	(72 821)	0
1976–77	147 897	28 055	61 759	15 490	0	(44 171)	(48 334)	(15 990)	(17 498)	(60 161)	(65 832)	0
1977–78	140 169	25 912	29 942	18 227	0	(32 012)	(34 317)	(23 729)	(25 438)	(55 741)	(59 755)	0
1978–79	168 820	27 713	33 460	17 948	0	(34 740)	(38 122)	(23 529)	(25 211)	(58 269)	(63 333)	0
1979–80	157 395	30 152	47 468	19 827	0	(40 534)	(48 040)	(23 143)	(26 932)	(63 677)	(74 972)	0
1980–81	156 786	31 048	26 896	20 529	17 769	(42 265)	(49 737)	(21 410)	(25 235)	(63 675)	(74 972)	0
1981–82	125 148	22 741	18 372	20 758	15 763	(31 577)	(37 173)	(35 028)	(41 127)	(66 605)	(78 300)	0
1982–83	134 430	27 742	29 993	18 892	13 746	(34 217)	(40 261)	(48 578)	(57 442)	(82 795)	(97 703)	0
Total	1 163 922	217 062	308 505	144 865	47 278	(309 956)	(354 241)	(204 045)	(233 447)	(514 001)	(587 688)	0

[a] Numbers in brackets are estimates.

Table B. Harvesting, site preparation, and planting and seeding data for Alberta

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	20 256	0	0	15 822	0	1 818	2 273	4 198	5 247	6 016	7 520	7 906
1976–77	19 060	0	0	14 944	0	761	952	4 038	5 045	4 799	5 997	6 470
1977–78	21 450	0	0	18 905	0	180	234	5 304	6 633	5 484	6 867	7 668
1978–79	22 103	0	0	18 635	0	110	129	7 035	8 218	7 145	8 347	5 416
1979–80	24 689	0	0	14 536	0	0	0	8 264	10 329	8 264	10 329	4 539
1980–81	23 042a	0	217	15 587	52	526	203	11 030	14 184	11 556	14 387	6 635
1981–82	20 517	0	0	18 721	184	4 152	6 084	8 837	11 730	12 989	17 814	4 701
1982–83	27 029	0	0	26 566	0	4 999	6 446	13 108	17 262	18 107	23 708	5 400
Total	178 146	0	217	143 716	236	12 546	16 321	61 814	78 648	74 360	94 969	48 735

[a] In 1980–81, 1981–82, and 1982–83, 6 720, 11 785, and 10 091 ha were cleared of aspen under a special stand conversion program and were not harvested in the commercial sense.

Table C. Harvesting, site preparation, and planting and seeding data for Saskatchewan

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	13 814	0	0	1 322	945	3 402	4 598	152	153	3 554	4 751	0
1976–77	9 727	0	0	2 820	2 897	3 928	5 378	511	759	4 439	6 137	0
1977–78	14 231	0	0	1 883	2 022	6 063	8 191	168	322	6 231	8 513	0
1978–79	14 909	0	0	4 530	1 804	6 004	9 841	587	1 174	6 591	11 015	0
1979–80	20 396	0	0	5 501	1 450	4 943	9 195	740	1 209	5 683	10 404	0
1980–81	20 746	0	0	7 056	0	3 352	6 200	757	1 400	4 109	7 600	0
1981–82	19 690	0	0	7 125	0	6 000	11 100	865	1 600	6 865	12 700	0
1982–83	(19 700)[a]	0	0	12 966	0	5 838	10 800	432	800	6 270	11 600	0
Total	133 213	0	0	43 203	9 118	39 530	65 303	4 212	7 417	43 742	72 720	0

[a] Numbers in brackets are estimates.

Table D. Harvesting, site preparation, and planting and seeding data for Manitoba

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	(15 700)[a]	0	0	3 965	0	(573)	1 335	(543)	1 266	(1 116)	2 601	223
1976–77	(17 000)	0	0	4 038	0	(743)	2 068	(303)	842	(1 046)	2 910	199
1977–78	(18 000)	0	0	4 080	0	(738)	1 406	(94)	180	(832)	1 586	61
1978–79	(20 000)	0	0	4 342	101	(917)	1 217	(303)	402	(1 220)	1 619	126
1979–80	(24 600)	0	0	3 823	533	(470)	1 293	(100)	275	(570)	1 568	2 774
1980–81	24 600	0	0	3 836	219	567	1 164	195	400	762	1 564	1 093
1981–82	18 900	0	0	4 161	0	3 445	4 000	689	800	4 134	4 800	272
1982–83	20 400	0	0	3 627	0	1 817	3 772	386	800	2 203	4 572	118
Total	159 200	0	0	31 872	853	9 270	16 255	2 613	4 965	11 883	21 220	4 866

[a] Numbers in brackets are estimates.

Table E. Harvesting, site preparation, and planting and seeding data for Ontario

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other[a] (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	140 896	55 864	0	45 231	0	27 284	(45 984)[b]	2 766	(4 791)	30 050	(50 775)	23 510
1976–77	114 171	42 550	0	39 157	0	24 165	(41 927)	2 005	(3 589)	26 170	(45 516)	27 039
1977–78	121 930	66 063	2 949	42 357	2 655	24 101	(43 343)	2 406	(4 381)	26 507	(47 724)	28 791
1978–79	141 381	53 617	4 247	40 307	4 152	25 189	52 928	2 360	5 487	27 549	58 415	23 582
1979–80	160 147	58 431	4 163	45 736	3 491	26 693	61 453	4 137	7 945	30 830	69 398	24 251
1980–81	217 157	25 522	2 362	50 624	3 634	27 146	65 360	4 934	10 497	32 080	75 857	47 294
1981–82	202 786	24 617	2 409	51 683	3 065	31 473	69 448	6 634	13 951	38 107	83 399	27 869
1982–83	200 337	22 584	5 277	60 527	5 180	30 278	63 660	7 564	16 465	37 842	80 125	29 991
Total	1 298 805	349 448	21 407	375 622	22 177	216 329	444 103	32 806	67 106	249 135	511 209	232 327

[a]Chemical site preparation.

[b] Numbers in brackets are estimates.

Table F. Harvesting, site preparation, and planting and seeding data for Quebec

Year	Harvesting[a]		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	104 609	30 485	0	3 008	0	(15 905)[b]	36 582	0	0	(15 905)	36 582	5 693
1976–77	140 106	41 631	0	2 570	0	(15 271)	35 124	(58)	132	(15 329)	35 256	1 810
1977–78	159 045	34 250	0	7 555	0	(16 348)	37 601	(196)	450	(16 544)	38 051	3 373
1978–79	185 908	40 219	0	(8 478)	1 061	(14 026)	32 259	(53)	122	(14 079)	32 381	5 703
1979–80	208 498	33 328	0	14 217	552	(14 039)	32 289	(23)	54	(14 062)	32 343	6 744
1980–81	199 920	45 080[c]	0	6 993	6 910	13 828	34 573	13	29	13 841	34 602	9 949
1981–82	204 000	46 000[c]	0	6 904	9 248	14 733	35 221	1 142	2 456	15 875	37 677	9 525
1982–83	159 120	35 880[c]	0	11 792[d]	3 008	15 696	37 579	1 381	2 881	17 077	40 460	14 506
Total	1 361 206	306 873	0	61 517	20 779	119 846	281 228	6 246	6 124	122 712	287 352	57 303

[a] Crown land only.

[b] Numbers in brackets are estimates.

[c] Includes cutovers on private land.

[d] Includes windrowing.

Table G. Harvesting, site preparation, and planting and seeding data for New Brunswick

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	(94 400)[a]	0	300	9 800	0	5 300	13 096	1 375	3 398	6 675	16 494	125
1976–77	(92 800)	0	500	10 500	0	5 450	13 467	2 600	6 425	8 050	19 892	550
1977–78	(86 500)	0	400	13 500	0	5 200	12 849	4 407	10 890	9 607	23 739	393
1978–79	(89 200)	0	1 000	15 000	0	8 100	20 015	2 600	6 425	10 700	26 440	0
1979–80	(100 000)	0	1 500	16 802	198	8 500	21 004	7 200	17 791	15 700	38 795	0
1980–81	(85 900)	0	656	16 591[b]	7 679	8 943	19 835	13 095	30 951	22 038	50 786	0
1981–82	(65 500)	0	2 284	20 374[c]	4 726	7 071	16 376	15 050	36 061	22 121	52 437	172
1982–83	(72 445)	0	1 952	12 231	4 418	7 922	11 250	14 536	28 842	22 458	40 092	9
Total	(686 745)	0	8 592	114 798	17 021	51 532	118 431	60 863	140 783	117 349	268 675	1 249

[a] Numbers in brackets are estimates.

[b] Includes 1 288 ha of burning and scarification.

[c] Includes 870 ha of burning and scarification and 108 ha of chemical treatment and scarification.

Table H. Harvesting, site preparation, and planting and seeding data for Nova Scotia

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	27 260	0	0	595	0	980	2 495	445	1 100	1 425	3 595	0
1976–77	26 285	0	0	634	0	777	1 925	453	1 120	1 230	3 045	10
1977–78	28 335	0	0	850	0	1 359	3 125	972	2 401	2 331	5 526	1
1978–79	32 120	0	0	2 608	0	1 907	3 045	1 383	3 416	3 290	6 461	127
1979–80	33 703	0	0	2 255	0	888	2 910	1 788	4 416	2 676	7 326	77
1980–81	35 000	1 439	0	1 952	6 058	1 244	2 567	2 496	5 514	3 740	8 081	0
1981–82	35 000	1 429	129	1 879	6 837	2 567	6 915	2 518	6 906	5 085	13 821	0
1982–83	35 000	710	65	1 118	6 227	1 312	3 616	2 918	7 541	4 230	11 157	55
Total	252 703	3 578	194	11 891	19 122	11 034	26 598	12 973	32 414	24 007	59 012	270

Table I. Harvesting, site preparation, and planting and seeding data for Prince Edward Island

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	1 600	0	0	0	0	40	100	80	200	120	300	0
1976–77	1 600	0	0	48	0	40	100	80	200	120	300	0
1977–78	1 600	0	0	0	0	40	100	80	200	120	300	0
1978–79	1 600	0	0	16	0	54	135	40	100	94	235	0
1979–80	1 780	0	0	566	0	44	110	40	100	84	210	0
1980–81	2 500	0	0	566	0	176	381	247	588	423	969	0
1981–82	2 700	0	0	280	9	25	63	465	1 150	490	1 213	0
1982–83	2 700	0	70	412	29	73	177	402	996	475	1 173	0
Total	16 080	0	70	1 888	38	492	1 166	1 434	3 534	1 926	4 700	0

Table J. Harvesting, site preparation, and planting and seeding data for Newfoundland

Year	Harvesting		Site preparation			Planting and seeding						
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	Bare-root area (ha)	Bare-root seedlings ('000)	Container area (ha)	Container seedlings ('000)	Total area planted (ha)	Total seedlings ('000)	Area seeded (ha)
1975–76	(15 700)[a]	0	0	0	0	0	0	0	0	0	0	0
1976–77	(14 700)	0	0	0	0	0	0	0	0	0	0	0
1977–78	(14 300)	0	0	28	0	0	0	0	0	0	0	0
1978–79	(17 600)	0	0	320	0	0	0	0	0	0	0	0
1979–80	(17 700)	0	0	1 508	0	0	0	184	460	184	460	0
1980–81	15 175	0	115	235	29	200	500	160	398	360	898	36
1981–82	13 454	0	76	1 097	144	1 074	2 243	779	1 625	1 853	3 868	54
1982–83	8 000	0	8	1 782	66	0	0	802	1 803	802	1 803	230
Total	116 629	0	199	4 970	239	1 274	2 743	1 925	4 286	3 199	7 029	320

[a] Numbers in brackets are estimates.

Table K. Harvesting, site preparation, and planting and seeding data for the Yukon Territory

Year	Harvesting		Site preparation			Planting and seeding (ha)
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	
1975–76	112	508	0	0	0	0
1976–77	104	456	0	0	0	0
1977–78	250	497	0	0	0	0
1978–79	299	636	0	0	0	0
1979–80	0	280	0	224	0	0
1980–81	58	0	0	0	0	0
1981–82	45	0	0	0	0	0
1982–83	43	0	0	0	0	0
Total	911	2 377	0	224	0	0

Table L. Harvesting, site preparation, and planting and seeding data for the Northwest Territories

Year	Harvesting		Site preparation			Planting and seeding (ha)
	Clear-cut (ha)	Other (ha)	Prescribed burning (ha)	Scarification (ha)	Other (ha)	
1975–76	706	0	0	0	0	0
1976–77	396	0	0	0	0	0
1977–78	688	0	0	0	0	0
1978–79	693	0	0	0	0	0
1979–80	629	0	0	0	0	0
1980–81	742	0	0	0	0	0
1981–82	903	0	0	0	0	0
1982–83	427	0	0	0	0	0
Total	5 184	0	0	0	0	0

Table M. Stand treatments in British Columbia

Year	Area of stand treatments (ha)				
	Fertilizing	Thinning	Mechanical weeding	Chemical weeding	Total
1975–76	0	1 244	597	0	1 841
1976–77	0	6 906	2 827	0	9 733
1977–78	7 449	12 432	3 554	0	23 435
1978–79	9 017	15 102	2 467	0	26 586
1979–80	6 202	22 629	4 448	0	33 279
1980–81	5 516	22 425	2 936	0	30 877
1981–82	15 746	18 671	2 220	1 040	37 677
1982–83	5 759	15 849	2 176	2 247	26 031
Total	49 689	115 258	21 225	3 287	189 459

Table N. Stand treatments in Ontario

Year	Area of stand treatments (ha)						
	Fertilizing[a]	Thinning	Pruning	Manual cleaning	Mechanical cleaning	Chemical[b] cleaning	Total
1975–76	844	19 857	1 221	4 805	0	6 550	33 277
1976–77	673	20 119	1 029	5 963	0	10 540	38 324
1977–78	547	24 349	1 823	8 780	23	17 328	52 850
1978–79	697	19 424	1 563	5 872	44	20 669	48 269
1979–80	366	13 617	1 632	6 665	16	16 932	39 228
1980–81	344	13 362	1 646	5 586	316	29 782	51 036
1981–82	355	11 444	1 609	4 553	462	23 021	41 444
1982–83	277	13 636	2 020	6 738	600	31 235	54 506
Total	4 103	135 808	12 543	48 962	1 461	156 057	358 934

[a] Includes cultivation and drainage.

[b] Aerial and ground application.

Table O. Stand treatments in Quebec

Year	Area of stand treatments (ha)				
	Fertilizing	Thinning	Mechanical weeding	Chemical weeding	Total
1980–81	0	3 684	157	6 988	10 829
1981–82	0	7 428	1 159	4 099	12 686
1982–83	0	6 446	—[a]	—	6 446
Total	0	17 558	1 316	11 087	29 961

[a] Not available.

Table P. Stand treatments in New Brunswick

Year	Area of stand treatments (ha)				
	Fertilizing	Thinning	Mechanical weeding	Chemical weeding	Total
1975–76	0	0	0	0	0
1976–77	0	0	0	0	0
1977–78	0	671	0	361	1 032
1978–79	0	1 175	0	632	1 807
1979–80	0	2 235	0	1 201	3 436
1980–81	110	5 615	0	13 199	18 924
1981–82	42	5 058	42	12 476	17 618
1982–83	83	5 997	85	12 098	18 263
Total	235	20 751	127	39 967	61 080

Table Q. Stand treatments in Nova Scotia

Year[a]	Area of stand treatments (ha)				
	Fertilizing	Thinning	Mechanical weeding	Chemical weeding	Total
1979–80	0	1 248	1 871	437	3 556
1980–81	0	6 015	146	1 290	7 451
1981–82	0	6 698	0	2 566	9 264
1982–83	0	4 477	22	1 424	5 923
Total	0	18 438	2 039	5 717	26 194

[a] Breakdown of 7 609 ha of stand treatments from 1975–76 to 1978–79 is not available.

Table R. Stand treatments in Prince Edward Island

Year	Area of stand treatments (ha)				
	Fertilizing	Thinning	Mechanical weeding	Chemical weeding	Total
1979–80	0	20	0	0	20
1980–81	0	45	1	3	49
1981–82	0	248	4	1	353
1982–83	0	1 024	0	88	1 112
Total	0	1 337	5	192	1 534

Table S. Stand treatments in Newfoundland

Year	Area of stand treatments (ha)			
	Fertilizing	Thinning	Stand reclamation	Total
1975–76	57	194	0	251
1976–77	0	236	0	236
1977–78	16	1 909	415	2 340
1978–79	0	1 672	655	2 327
1979–80	41	1 705	1 044	2 790
1980–81	28	5	0	33
1981–82	0	2 615	0	2 615
1982–83	98	3 653	150	3 901
Total	240	11 989	2 264	14 493

APPENDIX 3

MISCELLANEOUS DATA ON PLANTING AND SEEDING SUCCESS

Table A. Percentage of planted areas requiring re-treatment, 1980–81 to 1982–83

Table B. Percentage of direct seeded areas requiring re-treatment, 1980–81 to 1982–83

Table A. Percentage of planted areas requiring re-treatment, 1980–81 to 1982–83

Province	Area planted (ha)			Planting success rates (%)		Planted area requiring re-treatment (ha)			Percentage of total planted area requiring re-treatment
	Spruce	Pine	Total spruce & pine	Spruce	Pine	Spruce	Pine	Total spruce & pine	
British Columbia[a]	114 584	37 235	151 819	50.0[b]	80.0	57 292	7 447	64 739	42.6
Alberta[c]	37 265	5 387	42 652	90.0	80.0	3 726	1 077	4 803	11.3
Saskatchewan	11 406	5 838	17 244	95.0	80.0	570	1 168	1 738	10.1
Manitoba[c]	3 145	3 954	7 099	(75.0)[d]	(100.0)	786	0	786	11.1
Ontario[c]	55 690	42 184	97 874	58.0	78.0	23 390	9 281	32 671	33.4
Quebec	—[e]	—	—	—	—	—	—	—	—
New Brunswick	47 260	18 210	65 470	95.0	95.0	2 363	911	3 274	5.0
Nova Scotia	9 749	3 013	12 762	40.0	40.0	5 849	1 808	7 657	60.0
Prince Edward Island	1 014	203	1 217	88.0	88.0	122	24	146	12.0
Newfoundland	3 008	N/A[f]	3 008	100.0	N/A	0	N/A	0	0.0
Canada	283 121	116 024	399 145	66.8	81.3	94 098	21 716	115 814	29.0

[a] Spruce and pine account for 71% of all planting. Other species (Douglas-fir, hemlocks, western red cedar, western larch) are not included.

[b] Brushing and weeding required to maintain plantation.

[c] Spruce and pine planting breakdowns derived from nursery shipping figures.

[d] Numbers in brackets are estimates.

[e] Not available.

[f] Not applicable.

Table B. Percentage of direct seeded areas requiring re-treatment, 1980-81 to 1982-83

Province[a]	Area direct seeded (ha)			Seeding success rates (%)		Seeded area requiring re-treatment (ha)			Percentage of total seeded area requiring re-treatment
	Spruce	Pine	Total spruce & pine	Spruce	Pine	Spruce	Pine	Total spruce & pine	
Alberta	13 790	2 946	16 736	(90.0)[b]	(90.0)	1 379	295	1 674	10.0
Ontario	0	105 154	105 154	N/A[c]	48.0	N/A	54 680	54 680	52.0
Quebec	918	32 912	33 830	50.0	50.0	459	16 456	16 915	50.0
Nova Scotia	0	55	55	N/A	80.0	N/A	11	11	20.0
Canada	14 708	141 067	155 775	87.5	49.3	1 838	71 442	73 280	47.0

[a] These four provinces account for 98.6% of all direct seeding done in Canada. Seeding success rates for other provinces are not available.

[b] Numbers in brackets are estimates.

[c] Not applicable.